

Doctoral Thesis Summary

# **Financial Constraints on Small and Medium Enterprises (SMEs): Evidence from the Czech and Slovak Republic**

**Finanční omezení pro malé a střední podniky (MSP): evidence z České a Slovenské republiky**

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## ABSTRACT

Small and Medium Enterprises (SMEs) are considered to be one of the most important drivers of economic development for many developed and developing countries. Despite the significant contribution towards economic development, the existing literature on entrepreneurial finance shows that SMEs are facing more financial constraints compared to large firms. This thesis aims to examine financial constraints on SMEs from two different perspectives. The first goal of the thesis is to examine the determinants of collateral. The literature shows that the lack of collateral is one of the first and foremost problems for SMEs to access bank loans. Therefore, we would like to focus on the factors that affect collateral requirements on SME loans.

The second aim of the thesis is to investigate whether innovative SMEs experience higher financial constraints compared to the non-innovative SMEs in the loan market. The existing studies show that innovative SMEs are facing more financial constraints compared to the non-innovative SMEs because of high asymmetric information, lack of collateral, and so on. In that regard, we would like to examine whether the loan application of the innovative SMEs is more likely to be rejected by banks or not. If the loan applications are more likely to be rejected by the banks, then we may infer that innovative SMEs face higher credit constraints compared to their non-innovative peers.

Regarding the determinants of collateral, the empirical results did not prove any effect of asymmetric information on collateral. That suggests that information asymmetry may not be the prime cause for SMEs to pledge collateral security to the bank. Then considering banking relationships, we find that SMEs with more than one banking relationship are less likely to pledge collateral in their loan contact than the SMEs with exclusive one bank relationship. We also find that SMEs with a long-term banking relationship are less likely to provide collateral compared to the SMEs with a short-term banking relationship. The results also show that loan maturity has a positive relationship on collateral; hence, long-term loans are more likely secured with collateral compared to short-term loans. Concerning the bank-borrower distance, we did not find any effect of bank-borrower distance on collateral. On the other hand, we find that banking concentration increases the likelihood of pledging collateral. Thus, it could be said that bank competition is more desirable for SMEs to obtain loans with lower collateral.

Regarding the second objective of the thesis, we did not find any evidence that innovative (when grouped – product innovation, process innovation and R&D firms) SMEs are facing more financial constraints compared to the non-innovative SMEs. Similarly, when investigating separately, we also did not find any empirical support that the SMEs with product innovation are financially constrained. However, we find that the loan application of the process of innovative SMEs and R&D based firms is more likely

to be rejected. Therefore, this result suggests that the SMEs involved in the process innovation and investing in R&D are more likely to find it harder to access bank loans. Finally, as for the product and process innovation, we did not find any evidence that SMEs with the product innovation are facing more credit rationing than the process innovative firms. Therefore, product innovation is not a suboptimal choice for innovative SMEs.

## **ABSTRAKT**

Malé a střední podniky (MSP) jsou nedílnou součástí ekonomického rozvoje mnoha rozvinutých i rozvojových zemí. Navzdory jejich značné důležitosti v procesu ekonomického rozvoje každé země literární zdroje zaměřené na podnikové finance poukazují na skutečnosti, že MSP čelí většímu počtu finančních omezení než velké podniky. Cílem této práce je se zaměřit na finanční omezení MSP ze dvou odlišných pohledů. V první části se soustředíme na výzkum klíčových faktorů kolaterálu. Literární zdroje poukazují na fakt, že nedostatek kolaterálu je jedním z největších překážek MSP při žádostech o bankovní půjčky. Z tohoto důvodu je třeba se zaměřit na faktory ovlivňující kolaterální požadavky k půjčkám pro MSP.

Dalším cílem práce je zjistit zda inovativní MSP čelí větším finančním omezením než neinovativní MSP, které jsou rovněž součástí trhu s půjčkami. Současná literatura poukazuje na skutečnost, že inovativní MSP čelí většímu počtu finančních omezení než neinovativní MSP z důvodu asymetrických informací, nedostatku kolaterálu, atd. V této souvislosti bychom se chtěli zaměřit na skutečnost, zda žádost o bankovní půjčku podaná MSP má větší šanci být zamítnuta či udělena příslušnými bankami. Pokud je větší pravděpodobnost, že žádosti o půjčku budou bankami zamítnuty, pak můžeme dojít k závěru, že inovativní MSP čelí vyššímu počtu úvěrových omezení než podniky neinovativní.

Co se týče klíčových faktorů kolaterálu, empirické výsledky nepotvrdily žádný vliv asymetrických informací na kolaterál. To znamená, že asymetrické informace nejsou hlavní příčinou v případě MSP neplnění závazku vůči bankám. Pokud bereme v potaz bankovní vztahy, zjistili jsme, že MSP, které zažádaly u více než jedné bankovní instituce o půjčku, nejsou schopné plnit závazky vůči těmto bankám tak spolehlivě jako v případě navázání kontaktu pouze s jednou bankovní institucí. Rovněž jsme zjistili, že MSP, které mají dlouhodobý vztah s jednou bankovní institucí, nejsou schopné dostát svým závazkům tak spolehlivě jako MSP, které mají jen krátkodobý vztah s určitou bankovní institucí. Výsledky také potvrdily, že splatnost půjčky má pozitivní vliv na kolaterál, tedy půjčky s delší dobou splatnosti jsou lépe zajištěny kolaterálem než půjčky krátkodobého

charakteru. Co se týče aspektu vzdálenosti mezi příslušnou bankou a příjemcem půjčky, nebyl potvrzen žádný vliv tohoto typu na kolaterál. Avšak bylo evidentní, že výběr banky zvyšuje pravděpodobnost následně dostát svým závazkům. Je možné tedy tvrdit, že konkurence mezi jednotlivými bankami je pro MSP žádoucí za účelem obdržení půjčky s nižším kolaterálem.

Pokud jde o druhý cíl práce, nenalezli jsme žádné důkazy, že inovativní MSP (zabývající se inovací výrobků, procesů a podniky zabývající se oblastí výzkumu a vývoje) čelí většímu počtu finančních omezení než MSP neinovativní. Podobně tomu bylo i při výzkumu, který byl zaměřen na jednotlivé podniky, kdy nebylo empiricky doloženo, že MSP zabývající se inovací výrobků jsou jakkoliv finančně omezovány. Nicméně můžeme potvrdit, že je větší pravděpodobnost zamítnutí žádostí o bankovní půjčku, které byly podány inovativními MSP a podniky z oblasti vědy a výzkumu. Z tohoto vyplývá, že MSP zabývající se inovacemi procesů a oblastí vědy a výzkumu mají komplikovanější přístup k bankovním půjčkám. Závěrem je třeba zmínit, že v případě inovací výrobků a procesů jsme neshledali žádné důkazy, že MSP zabývající se inovací výrobků čelí vyšší úvěrové bonitě než podniky zabývající se inovací procesů. Oblast inovací výrobků tedy není jednou z optimálních oblastí zájmu inovativních MSP.

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# LIST OF ABBREVIATIONS

GDP = Gross Domestic Product

ROA = Return on Assets

ROE = Return on Equity

OECD = Organisation for Economic Co-operation and Development

CSO = Czech Statistical Office

SSO = Slovak Statistical Office

CNB = Czech National Bank

NBS = Národná Banka Slovenska (National Bank of Slovakia)

## 1. INTRODUCTION

Small and Medium Enterprises (SMEs) are an integral part of economic development for many developed and developing countries. According to the European Union (EU), SMEs are solely responsible for creating 99% of employment in the EU. Similarly, by using the World Bank data set on 70 developed and developing countries, Ayyagari, Beck and Demircuc-Kunt (2007), show that SMEs create about 60% of jobs in the manufacturing sector and hence the SMEs are playing a pivotal role for the sustainable economic development. Despite the importance of SMEs in the economic development of the countries, SMEs are usually financially constrained from banks and other external lenders because of information asymmetry. The main argument behind the information asymmetry is that SMEs are unable to show their creditworthiness due to lack of physical assets, audit reports, lack of separation between the owner and the business, and so on. Because of information asymmetry, it is difficult for banks and external lenders to measure the credit risk of firms, and thus, they are reluctant to lend to the SMEs.

A few studies showed that the collateral requirements on a loan contract are a traditional bank practice to eliminate information opacity and to align the interest of borrowers with the interest of banks (Besanko and Thakor, 1987; Boot, Thakor and Udell, 1991). Beck, Demircuc-Kunt, Laeven and Maksimovic (2006) used the World Business Environment Survey (WBES) and find that collateral requirement is the third most important financing difficulty for SMEs while high-interest rates and lack of long-term loans are the first and second barriers.

Empirical research shows that the loans granted to the SMEs are mainly collateralised and the impact of collateral in the SME loan segment is quite significant. A study by



Rahman, Belas, Kliestik and Tyll (2017) on the Visegrad countries (Czech Republic, Slovak Republic, Poland and Hungary) shows that about 70% of the loans in these countries are collateralised. Similarly, Davydenko and Franks (2008) found that 75.7 % of loans are secured in France, and while they observed that 88.5 % of loans are secured in Germany. Similarly, Degryse and Cayseele (2000) show that 26% of loans are secured in Belgium. In the case of the USA, Steijvers, Voordeckers and Vanhoof (2010) found that about 87 % of loans are collateralised with various types of assets and with some covenants. Menkhoff, Neuberger and Rungruxsirivorn (2012) found that around 15 % of loans are collateralized in Thailand. Therefore, the existing studies quite overwhelmingly shows that the impact of collateral is enormous in SME lending.

Apart from the collateral-based lending, the current literature in the field of financial constraints emphasised that financing difficulties can be more severe for the innovative SMEs and the R&D projects than the usual investment in a capital project. According to Hall (2010), information asymmetry may apply to R&D project severely than that of the capital project because the external lending parties do not know the final output of the investment. One of the main arguments behind this proposition is that the investment in R&D based firms are riskier due to their more uncertain investment nature, and the result of the R&D investment is difficult to predict by the external capital suppliers.

The existing research on innovative SMEs and financial constraints reveal that there is a structural problem for the innovative firms in getting bank finance. It is more often that innovative SMEs get a lower amount of external finance than that it is required to complete the projects successfully. In line with that, Canepa and Stoneman (2008) find that financial problem is the determinant factor that is affecting more to innovative SMEs; especially those are involved in technological innovation. They argue that technological output is more uncertain than a conventional capital investment project. Hall (2010) argued that SMEs that are involved in innovation are much more information opaque than the regular capital investment projects; hence, they experience more credit rationing compared to the non-innovative SMEs. Therefore, why the innovative SMEs are facing credit rationing more than their non-innovative counterparts is an important issue to explore in SME financing arena. At the same time what can be done to minimize credit rationing to innovative SMEs could be beneficial for the SMEs in the Czech and Slovak Republic as well as for the SMEs in the other EU countries.

As the thesis is based on the financial difficulties experienced by SMEs concerning the Czech and Slovak Republic, it is necessary to highlight the reasons why we have chosen these countries for this thesis. First, the issues that we have chosen for our research have never been studied before in our examined countries. Hence, there is a research gap to investigate the issues related to collateral requirements for SMEs in the Czech and Slovak Republic. Additionally, whether innovative SMEs are facing credit rationing from banks or not is an open research question from our examined countries perspective. Therefore, by doing the research, we can identify the reasons, why banks

are asking for collateral on their loan contract and what are the main determinants of collateral-based lending? Also, if there is a credit rationing exists for the innovative SMEs, then it can be significant for the SME owners, researchers, and for the policymakers to understand the effect of financial constraints on innovative SMEs. Therefore, the policymakers can implement policies to overcome these issues related to financial constraints to foster the economic development of the country. Secondly, SMEs in these countries are extremely important for overall economic development and playing an important role in alleviating unemployment. A study by Ayyagari, Beck and Demirguc-Kunt (2007) find that SMEs create about 65% of employment in the Czech Republic, while 59% of the employment is created in the Slovak Republic. A later study by Daszkiewicz (2014) finds that SMEs in the Czech and Slovak Republic are responsible for creating about 99% of business establishment.

## **1.2 Thesis Structure**

The rest of the thesis is organised as follows. The chapter 2 of the thesis provides a critical review of the existing studies on collateral-based lending and credit rationing to innovative SMEs. In this chapter we would like to explore the main research stream of collateral-based lending and the financial constraints on innovative SMEs. By doing so we can identify our research gap and research objectives of the thesis. In chapter 3 we discuss research gap and the research aim. At the same time, we present research questions and research objectives that we would like to address in the thesis. The methodological part of the study is presented in Chapter 4. This chapter provides a detailed description of the data collection and data analysis method. The hypotheses of the study those will be empirically examined are also discussed in this chapter. This chapter also contains the econometric model of the study with a detailed reasoning for the model selection and model development. The dependent and independent variables of the thesis is also documented in this chapter with expected results and possible relationships. The descriptive and empirical analysis of the study is documented in chapter 5. This part of the thesis is divided into two main parts. In the first part we provide the descriptive analysis and followed by the econometric results of the study.

In chapter 6 presents a summary of the main findings of the thesis. In this chapter, we also discuss the main contributions of the study, managerial implications, and policy recommendations. Finally, the study concludes with some limitations of the current study and a few directions for future research.

## **2. LITERATURE REVIEW**

The Financial constraints on SMEs are an ongoing topic in entrepreneurial finance. The limited access to bank finance for the SMEs has been an issue that is far from settled in both developed and developing countries.

The access to bank finance for SMEs can be affected by various factors, for example, asymmetric information, lack of collateral, borrower capacity, business quality, size of the business, banking market structure, bank-borrower distance and so on. However, the lack of collateral is identified as one of the major obstacles for which SMEs are credit constrained from banks. Since SMEs are small, and they often possess a very limited amount of physical assets that can be pledged as collateral to the bank. Hence, the loan applications of the SMEs are rejected or most of the time being denied by bank loans that they have requested for.

Considering innovative SMEs, the long-run economic growth of the firm depends on their knowledge creation ability and by which they can innovate new products and services. These new products and services can create a unique competitive advantage for the firms, and that may allow them to survive for a longer time by having a sustainable cash flow stream. However, as per the existing studies, the innovation of the firms is constrained by external finance from the lenders. Therefore, due to the lack of external sources of finance, innovative firms are largely depended on their equity capital.

The rest of the chapter is organised as follows. Section 2.1 discusses the implications of collateral-based lending. In Section 2.2 we discuss the credit rationing to innovative SMEs.

## **2.1 Implications of Collateral in SME Lending**

### **2.2.1 Asymmetric Information, Relationship Lending and Collateral**

The extent of asymmetric information often restricts financing to small and medium enterprises. Due to the extent of the information gap, it is hard for the external lenders to evaluate borrower quality and hence, banks and lending institutions are reluctant to provide loans to the SMEs. Relationship banking is considered as one of the most common lending technologies to alleviate asymmetric information between the banks and borrowers.

Kislat, Menkhoff, and Neuberger (2017) investigated the effect of relationship lending in minimising the collateral requirement for SMEs in Thailand. The paper examines the reliance on collateral in different credit market segments- formal (banks), semi-formal (credit institutions) and informal lending by local lenders in rural villages. They have used the survey “vulnerability to poverty in Southeast Asia” more than 2000 lenders in the survey. The result shows that when a bank extends credit through relationship-based lending, it helps to reduce the incidence of collateral for the SMEs. Therefore, relationship lending is beneficial for SMEs to reduce collateral. Hence, the authors argue that relationship lending is not creating a hold-up problem for the SMEs.

From the asymmetric information point of view, Moro and Fink (2015) examined whether the reduction of information asymmetry can affect access to credit for SMEs.

They have collected data from 14 local community banks in northern and central Italy by covering 828 SME loans. The paper finds that SME with lower credit asymmetric information can obtain finance with lower collateral. Thus, the lower asymmetric information helps SMEs to obtain more finance.

### **2.2.2 Bank-Borrower Distance and SME Financing**

The studies on bank-borrower distance argue that the soft information extraction from the borrowers is significantly depended on the distance between the bank and the borrower (Petersen and Rajan, 2002). The studies argue that being closer to the borrower, banks can use their locational advantage to get to know more about the borrower, and that can help to minimise the credit risk of the loan. Specifically, the studies argue that the collection of borrower specific site information is locational, and it is difficult to communicate when the distance is larger between the bank-branch and the borrower (Berger and Udell, 2002).

Duarte, Gama and Esperanca (2017) analysed collateral requirement for SMEs and the pledge of business collateral vs personal collateral. The dataset of the paper was obtained from the EBRD database of BEEPS survey between 2012 and 2014. It was found that firms in distant location need to provide higher collateral because of high-risk estimation by the banks. The authors argue that due to distance, the loan officer has less information about the borrower; therefore, the loan officer needs to rely on hard financial data. However, by imposing collateral on the loan contact banks can optimise the distance-related diseconomies.

### **2.2.3 Bank Competition, Concentration and Collateral**

Empirical research shows mixed evidence for both bank competition and concentration and its effect on access to SME finance. One stream of research shows that in a competitive market, SMEs have lower credit restrictions from banks because of easier loan screening process (Leon, 2015). The above studies argue that due to competitive pressure in the market, banks usually take less strict screening process and that helps SMEs to get more credits from the banks, which would have been difficult otherwise. As opposite to competition, in a concentrated market, a few numbers of a bank hold most of the market share in the banking sector and which can have a positive and negative effect on the financial constraints. Petersen and Rajan (1995) show that concentration has a positive effect on bank finance to SMEs.

Hainz, Weill and Godlewski (2013) examined the impact of bank competition and the use of collateral in 70 developing and developed countries. The data of the paper collected from Loan Pricing Corporation (LPC, Reuters) covering about 4931 bank loan data and Lerner Index was used a measure of bank market power. It was found that

collateral requirement reduces as market competition increases between banks. The authors posit that banks can take strict screening policy by which they can reduce the number of bank loan defaults and the banks can only lend to creditworthy borrowers when the competition in the market is intense. Thus, competition and collateral are negatively associated.

#### **2.2.4 Loan Maturity and Collateral**

According to Beck, Demirguc-Kunt, Laeven and Maksimovic (2006), lack of long-term bank loans is the second most important financial constraint for the SMEs in their analysis from 12 most important financing difficulties. That proposes shorter loan maturity is an actual problem for SMEs. Lack of long-term bank loans is identified as one of the critical issues in entrepreneurial finance because SMEs are facing barriers to invest for a longer period and hence effecting their business growth.

Voordeckers and Steijvers (2006) examined collateral requirement for SMEs in a banking relationship by analysing a sample of 234 credit lines data from a large Belgian bank from 2000 – 2003. The paper also highlighted the importance of collateral in determining loan maturity for small businesses. The paper finds that the long-term loans are mainly collateralised, and the short-term loans are provided on the personal guaranty. Specifically, it was found that banks in Belgium are providing long-term loans by keeping fixed assets such as land, building and personal assets as collateral. The study shows that fixed assets as collateral for long-term loans can reduce adverse selection and moral hazard issue in a loan contract. Therefore, when the borrower is engaged with a long-term loan contract, they are usually providing fixed assets as collateral.

## **2.2 Financial Constraints and Innovative SMEs**

Innovation is considered to be one of the most important determinants for the firm's growth because innovation can create a competitive advantage in the market (Galia and Lergos, 2004). Schumpeter (1942) acknowledged the importance of constant innovation tendency of the firm and how the innovation of new products can enhance the economic growth of a country by creating new demands in the market. Freel (2007) stressed that the importance of new products development is ever-growing due to intensified competition, technological development and because of changes in customers' demand. The long-term success of the small firms is largely depended on their capacity to innovate and adopt new technologies in their processes. The development of products and adoption of new processes within the core businesses of SMEs can increase their productivity and market capitalisation by which the survival rate of the SMEs can be enhanced (Cefis and Marsili, 2006).

To examine financial constraint on SMEs, a handful of research shows that innovative firms are facing the severity of financial constraints more than the non-innovative firms.

Several theories have been put forward to examine the reasons for financial constraints experienced by innovative SMEs. It is argued that SMEs that are involved in innovation are much more information opaque than the regular capital investment projects; hence, they experience credit rationing (Hall, 2010). Hall posits that the final output of investment in innovation activities are not known to the external lenders, and because of that, external lenders are reluctant to lend capital in innovative SMEs. Additionally, the costs in innovative projects are dedicated before any production starts and sometimes considered as sunk costs. Hence, it may not be suitable for SMEs to invest in projects that require a substantial amount of upfront expenses (Seaton and Walker, 1997).

### **2.2.1 Empirical Studies on Innovative SMEs and Financial Constraint**

A handful of research examines credit rationing on innovative SMEs by focusing on different markets. A study by Freel (2007) shows that firms that are introducing novel products, employing more qualified researcher and involved in R&D activities face relatively higher credit restrictions in compared to the non-innovators in the UK. While comparing between product and process innovation, the study also reports that the product innovation is more likely to be associated with a higher credit rationing comparing with process innovation. The study showed that firms that were engaged in the process innovation their probability of being unsuccessful in the loan application are 13.5% whereas, firms introducing novel or new products their probability of credit rationed from the bank is 18.1%. The author argues that there is a high risk of product failure in the market than the internal process failure and hence, new product innovators are more likely to face higher credit rationing. It was found that firms that are employing for qualified scientist, engaged in R&D activities are more likely to be credit rationed than the firms without engagement in R&D activities.

Herrera and Minetti (2007) investigated the association between relationship banking and its impact on innovation for SMEs in the Italian market. The data of the paper provided by “VIII Indagine Sulle Imprese Manifatturiere” survey conducted by Italian banking group Capitalia-Mediocredito Centrale in the year of 2001 among 4680 manufacturing firms. The study used borrower credit duration as a proxy for measuring the depth of the relationship between banks and borrower. The results show that the length of a banking relationship has a positive impact on the product and process innovation. However, the significance of relationship banking is more on the product innovation than the process innovation. The authors argue that the impact of length of a relationship on product innovation could be affected by the depth of information sharing and also increased trust between banks and borrowers.

## **2.3 Summary**

The studies on SME financing argue that the information problem of the SMEs can be alleviated by pledging collateral security to the banks (Duarte, Gama and Esparanca, 2017). On the other hand, the opponents of collateral-based studies argue that collateral is one of the main barriers for SMEs to access bank loans and which imposes additional restrictions on small firms access to external finance (Davydenko and Frank, 2008; Menkhoff, Neuberger and Rungruxsirivorn (2012). It was argued that SMEs are small, and they have limited access to collateral or fixed assets that can be pledged as collateral to the bank and hence they are denied from bank loans. Therefore, the evidence on collateral-based lending is quite ambiguous and difficult to understand the impact of collateral on SME financing.

With respect to innovative SMEs, it appears that SMEs that are involved in R&D activities and product or process innovation is more likely to be credit rationed from external lenders than of the non-innovators or the firms that are not engaged in R&D activities (Freel, 2007; Hall, 2010; Lee, Sameen and Cowling, 2015). However, credit rationing and its effect on innovative SMEs have never been studied before in the context of the Czech and Slovak Republic. Hence, this is giving us the opportunity to explore the reasons for credit rationing and to fill-up this research gap from our examined country perspective. Moreover, the Czech and Slovak Republic are bank-based economies, and thus, in this research, it might be possible to see the extent of bank credit rationing to innovative SMEs. The current thesis can be helpful for other bank-based countries as well for understanding the financial problems towards the innovative SMEs.

## **3. RESEARCH AIM**

### **3.1 Research Gap and Research Problem**

The role of collateral as a borrower screening device is prominent in banking studies. However, these studies are concentrated on a single country and dominated by the US market (Berger and Udell, 2006). There are other studies concentrated on the European market (Cowling, 1999 – UK; Jimenez and Saurin, 2004 – Spain; Hernandez–Canovas, Martinez–Solano 2006 – Spain; Duarte, Gama and Esparanca, 2016 – Portugal). There are studies based on cross-country analyses, but they cover both developing and developed markets (Godlewski and Weill 2011; Duarte, Gama and Esparanca, 2017).

The issue of collateral-based lending is an open research question in the Czech and Slovak Republic. In this thesis, we would like to understand the drivers of collateral in bank-based economic countries like the Czech and Slovak Republic. We want to shed light on why banks ask for collateral while lending to SMEs, not on the effect of collateral in accessing bank loans. As per our knowledge none of the studies examined the

determinants of collateral in these countries and thus it is giving us an opportunity to explore this area.

As stated earlier, the growth of innovative SMEs and the success of innovative projects largely depend on the funding available for the firms to invest in R&D. Ughetto (2008) finds that internal finance plays a significant role for SMEs in the Italian market to finance their innovative ideas. However, it is difficult for a firm to continue its growth and expansion activities only from their internal finance and it is well documented in entrepreneurial finance that the external bank finance is vital for the innovative SMEs to grow and become competitive in the market. Nevertheless, the innovative SMEs are largely considered to be more information opaque firms and thus they are credit rationed. However, whether innovative firms are credit rationed only due to information opacity and if they face credit rationing due to information opacity what type of credit rationing, they are facing is a question that is far from settled in the SME financing literature. Therefore, why innovative firms credit is rationed if so, how we can alleviate the credit rationing for SMEs is an interesting question to address.

### **3.2 Research Aim**

Considering the above research gap, this thesis aims to examine financial constraints on SMEs in the context of the Czech and Slovak Republic from two different perspectives. At first, we would like to examine the factors that affect collateral requirements on loan contract. More specifically, we would like to assess the determinants of collateral SME lending. In line with that we would also like to explore the collateral to loan ratio in SME lending. The excessive amount of collateral compared to the loan size is also a critical issue for the SMEs, as many cases SMEs are credit rationed because they cannot provide higher amount of collateral that is demanded by the bank.

Second, we want to examine credit rationing to innovative SMEs. To be specific, we would like to assess whether the SMEs that are involved in the product and process innovation and investing R&D activities are credit rationed compared to the non-innovative SMEs or not and if so, what measures can be taken to increase access to finance for innovative SMEs. Theoretically, credit rationing is divided into two types. Type 1 credit rationing suggests that the borrower does not get any loans on their loan application. That means the loan application of the borrower is being rejected by lenders (Stiglitz and Weiss, 1981; Bester, 1985). On the other hand, type 2 rationing means the borrower received a lower amount of loans although the borrower demanded higher amount and ready to fulfil credit terms or willing to pay the market interest rate to the lenders (Jaffee and Russell, 1976). Type two rationing is also known as loan size rationing or partial credit rationing, where the borrower has received a portion of loan amount rather than being completely denied. In this thesis, we will focus on both type 1 and type 2 rationing for innovative SMEs in the Czech and Slovak Republic. As it could



be interesting to analyse the factors that enable banks to reject the loan application of the innovative SMEs and why some of SMEs are being partially credit rationed.

### **3.3 Research Question**

To investigate the issue of collateral-based lending and credit rationing to innovative SMEs, this research will address the following questions, by which we can find out the determinants of collateral, and if there any credit rationing phenomenon exists concerning innovative SMEs in the Czech and Slovak Republic.

1. What is the effect of information asymmetry on collateral requirements?
2. Is there any effect of relationship banking on collateral-based lending?
3. How the bank-loan maturity structure affect bank decision on collateral-based lending?
4. Is there any effect of bank market structure on collateral? Specifically, whether bank competition and concentration affect the propensity of collateral-based lending?
5. What is the effect of bank-borrower distance on collateral?
6. Whether innovative SMEs are facing more credit rationing than of the non-innovators?
7. And whether the product innovative SMEs faces more credit rationing compared to the process innovative SMEs or not.

### **3.4 Research Objective**

The main objective of the research is to investigate collateral-based lending in the segment of SMEs and to examine why innovative SMEs are credit rationed for the Czech and Slovak Republic. However, the main goal of the research will be addressed by achieving the below mentioned partial objectives:

- To identify the effect of asymmetric information on collateral.
- To explore the effect of relationship banking on collateral. Whether relationship banking is suitable for SMEs to reduce collateral requirements or not?
- To identify the effect of bank-loan maturity on collateral.
- To estimate the impact of bank market structure on collateral. By doing so, we can identify the relationship between bank competition and concentration on collateral.

- To find the effect of bank-borrower distance on the use of collateral concerning SME lending. That means that to explore the impact of bank organisational diseconomies on the use of collateral.
- To explore credit-rationing phenomenon for innovative SMEs and SMEs that are involved in R&D activities.
- Provide recommendations on how to facilitate access to finance to innovative SMEs.

## **4. METHODOLOGY**

### **4.1 Data**

The data set of the study is collected mainly by doing a primary survey from March to August 2018. We have sent an online questionnaire translated in both Czech and Slovak language randomly to about 1000 firms in the Czech and Slovak Republic. The questionnaire was divided into different sections focusing on collateral and innovative SMEs financial issues. The questionnaire had 27 questions, and in the first section of the questionnaire we have asked about the basic information about the firms, then we included innovation activities of the firms, and then we asked about the financial issues related to SMEs. The questionnaire a few multiple-choice questions, and there were close-ended questions (Yes/No). Despite our best effort through phone calls and follow-up emails, we were successful in obtaining 106, and 112 (218 in total) completed questionnaires from the Czech and Slovak Republic, respectively. The response rate of the survey was about 21.4%, which is quite low, but as the response was voluntary so we couldn't force the businesses to send us the filled-up questionnaire. The market-level data, such as bank-competition and concentration data are collected from the Beck, Demirguc-Kunt and Levine (2000) Global Financial Development Database (GFDD), updated in 2017.

### **4.2 Hypotheses**

#### **4.2.1 The Determinants of Collateral**

This study aims to assess financial constraints on SMEs from two different perspectives. First, we would like to investigate the factors that determine collateral-based lending. Although collateral could impose a significant barrier for small firms to get bank finance, still collateral-based lending is a common technique for banks to provide loans to small firms. Hence, we developed hypotheses to analyse collateral-based lending, including both firm-specific factors and market-based factors, by which we can provide a comprehensive result on SME financing and collateral-based lending. For the

interest of the length of the thesis summary, we are going to show the hypotheses only and the details discussion about the selection of hypotheses are presented in the thesis.

***H1: Firms with a high asymmetric information are more likely to provide collateral in their loan contract, and the ratio of collateral to loan size should be higher with the extent of information asymmetry.***

***H2: Firms with previous banking relationship are less likely to provide collateral in their loan contract and the ratio of collateral to loan size should be lower with the banking relationship.***

***H3: The probability of firms having collateral and the ratio of collateral to loan size increases as the distance between the banks and borrowers increases.***

***H4: The probability of firms pledging collateral and the ratio of collateral to loan size increases as the competition in the market increases and collateral is negatively related to concentration in the market.***

***H5: The probability of firms having collateral increases and the ratio of collateral to loan size as the maturity of the loan increases.***

#### **4.2.2 Financial Constraints and Innovative SMEs**

It was found that innovative SMEs are facing the severity of asymmetric information more than the non-innovative firms (Freel, 2007; Hall, 2010). The above studies observed that innovative SMEs are more likely to face asymmetric information because it is harder for external lenders to measure the success rate of the innovation output. Hence, considering the above literature, it is more likely that the innovative SMEs would face a higher credit rationing in compared to the non-innovative firms.

***H6: The probability of credit rationing is higher for the innovative SMEs than non-innovative firms.***

The studies on innovative SMEs showed that firms that are introducing new products in the market are more likely to face the credit rationing more than the process innovation (Freel, 2007). Due to the nature of riskiness involved in the product innovation, it is more likely that external lenders are sceptical about investing in the product innovation hence, making it difficult for the product innovator to get external funds.

*H7: The probability of credit rationing is higher for the product innovator than the process innovator.*

### **4.3 Model Specification: The Determinants of Collateral**

As discussed above, in this thesis we would like to investigate the determinants of collateral and ratio of collateral to loan size from five different perspectives (asymmetric information, relationship lending, bank-borrower distance, bank competition and loan maturity structure) in the Czech and Slovak Republic. Hence, we formulate our model as:

$$P (\text{Collateral}) = f(I_i, R_i, D_i, C_i, M_i) \quad (4.1)$$

Where  $P$  is the probability of pledging collateral and  $I_i$  is the information factor,  $R_i$  represents the relationship banking-related variables;  $D_i$  is the distance and  $C_i$  is the local banking market competition, concentration variable and  $M_i$  is the maturity of the loan.

By considering the above equations, we could develop a liner model by which it is possible to simplify the models, and the specification of collateral can be derived as:

$$P (\text{Collateral}) = \beta_0 + \beta_i X_i + F \text{ controls} + \varepsilon_i \quad (4.2)$$

Where  $P$  is the probability of pledging collateral in a loan contract,  $\beta_0$  is the intercept,  $\beta_i$  is a set of a parameter that will be estimated in this research and  $X_i$  is a set of independent variables. We control for some firm-level variables ( $F \text{ controls}$ ), which could also possibly impact the pledge of collateral and  $\varepsilon_i$  is the error term.

### **4.4 Model Specification: Credit Rationing to Innovative SMEs**

According to the second broader aim of this study, we would like to investigate the credit rationing phenomenon on innovative SMEs. It was argued that innovative firms are more information opaque than the regular manufacturing firms and hence, they are credit rationed (Freel, 2007; Belas, Rahman, Rahman and Schonfeld, 2017). Hence, in

this study, we hypothesised that it is more likely that innovative SMEs are more credit rationed than the non-innovative SMEs.

We want to investigate the following model to estimate credit rationing to innovative SMEs in the context of our examined countries:

$$P (\text{Credit Rationed}) = f(IN_i) \quad (4.3)$$

Where  $P$  is the probability of being credit rationed in a loan contract and  $IN_i$  is the explanatory variable for innovation. We define innovation as if the firm engaged in any innovation activity within the last three years, for example, product, process or investment in R&D activities.

As discussed, in this thesis, we also would like to investigate both types of credit rationing, for example, full credit rationed, and partial credit rationed. Therefore, we formulate our estimation model as:

$$P (\text{Partially Rationed}) = f(IN_i) \quad (4.4)$$

Where  $P$  is the probability of being partially credit rationed in a loan contract and  $IN_i$  is the explanatory variable for innovation.

The studies on innovative SMEs argued that the product innovator is likely to face the credit rationing more than the process innovator. The intuition is that the process innovation is less risky compared to the product innovation (Freel, 2007).

In this thesis, we also hypothesised that the probability of credit rationing could be higher for the product innovator than the process innovator. Hence, our estimation model is as follows:

$$P (\text{Partially Rationed}) = f(ProdIN_i + ProcessIN_i) \quad (4.5)$$

Where  $P$  is the probability of being credit rationed in a loan contract and  $ProdIN_i$  is the explanatory variable for product innovation, and  $ProcessIN_i$  is the process innovation.

## 4.5 Dependent and Independent Variables

The dependent and independent variables are determined based on the goal of the thesis. The first broader goal of the thesis is to analyse the factors that affect collateral-based lending and the second broader goal of the thesis is to examine whether innovative SMEs are credit rationed or not. Since, each of the issue is distinctive in nature and thus, the dependent variables and independent variables are different in our study. Therefore, we encounter the issue by segregating independent and dependent variables by collateral-based lending and financial constraints on innovative SMEs. The selection of dependent and independent variables is explained in the thesis:

### 4.5.1 Dependent and Independent Variables: Collateral-based Lending

Table 4. 1: Definition and Sources of Variables

<b>Variable</b>	<b>Definition</b>	<b>Source</b>
<b>Dependent Variables</b>		
Collateral	Equals 1 if the firm has pledged collateral to obtain a bank loan (0,1)	Author Survey
Collateral to Loan ratio	The ratio of collateral value to loan amount	Author Survey
<b>Control Variables</b>		
Female	Equals 1 if one of the firm owners is female (0,1)	Author Survey
Education_Owner	Education of the owner	Author Survey
Experience_Owner	Experience of top manager measure in years	Author Survey
Product_innovation	Equals 1 if the firm has introduced any new products within the last three years (0,1)	Author Survey
Process_innovation	Equals 1 if the firm has introduced any new process within the last three years (0,1)	Author Survey
Research_RD	Equals 1 if the firm has invested in R&D within the last three years (0,1)	Author Survey
Micro	Equals 1 if the firm is a Micro firm (0,1)	Author Survey

Manufacturing	Equals 1 if the firm is a manufacturing firm (0,1)	Author Survey
<b>Independent Variables</b>		
Firm age	The number of years the business is in operation	Author Survey
Audit	Equals 1 if the firm financial statements are audited by a third party (0,1)	Author Survey
No_Bank_Relationship	Number of banks the borrower is maintaining business or personal account	Author Survey
No_Services_Bank	Number of products or services the borrower have used from the bank that provided the loan	Author Survey
Years_Bank_Relationship	Number of years the borrower is maintaining bank accounts with the bank that provided the	Author Survey
Maturity	The duration of the loan	Author Survey
Capital City	Equals 1 if the firm is located in the capital city (0,1)	Author Survey
Concentration	The asset share of the three largest banks in total banking system assets	GFDD (Beck et al. 2000)

Source: Authors own construction

#### 4.5.2 Dependent and Independent Variables: Financing to Innovative SMEs

Table 4. 2: Definition and Sources of Variables

<b>Variable</b>	<b>Definition</b>	<b>Source</b>
<b>Dependent Variables</b>		
Approved	Equals 1 if the loan application was approved and zero otherwise (0,1)	Author Survey
Fully Approved	Equals 1 if the loan application was fully approved and zero otherwise (0,1)	Author Survey
<b>Control Variables</b>		
Age	The number of years to business is in operation	Author Survey
Education_Owner	Education of the owner	Author Survey
Experience_Owner	Experience of top manager measure in years	Author Survey

Female	Equals 1 if one of the firm owners is female (0,1)	Author Survey
Audit	Equals 1 if the firm financial statements are audited by a third party (0,1)	Author Survey
Micro	Equals 1 if the firm is a Micro firm (0,1)	Author Survey
Manufacturing	Equals 1 if the firm is a manufacturing firm (0,1)	Author Survey
Capital_city	Equals 1 if the firm is in the capital city (0,1)	Author Survey
No_Bank_Relationship	Number of banks the borrower is maintaining business or personal account	Author Survey
No_Services_Bank	Number of products or services the borrower have used from the bank that provided the loan	Author Survey
Years_Bank_Relationship	Number of years the borrower is maintaining bank accounts with the bank that provided the	Author Survey
Concentration	The asset share of the three largest banks in total banking system assets	Beck et al. (2000)
<b>Independent Variables</b>		Author Survey
Innovation	Equals 1 if the firm has introduced any new products, processes or R&D within the last three years (0,1)	Author Survey
Product_innovation	Equals 1 if the firm has introduced any new products within the last three years (0,1)	Author Survey
Process_innovation	Equals 1 if the firm has introduced any new process within the last three years (0,1)	Author Survey
R&D	Equals 1 if the firm has invested in R&D within the last three years (0,1)	Author Survey

Source: Authors own.

## 5. EMPIRICAL ANALYSIS

### 5.1 Econometric Results

In this part, we present the econometric results of the thesis. The section begins with the results of collateral-based lending, and then we present the results of financing



difficulties on innovative SMEs. In the first phase of collateral-based lending, we provide the determinants of collateral, mainly where we present the factors that influence banks to ask for collateral from the borrowers. In the subsequent section we present the detailed analysis on financial constraint on innovative SMEs.

### 5.1.1 Econometric Results: The Determinants of Collateral

Table 5.1 reports the empirical results of our binary logistic model in the Czech and Slovak Republic. In our model, collateral is a binary variable which determines whether a borrower needed to pledge collateral while asking for bank loans and if not, then the loan was without collateral. Due to the page restrictions, we did not report the result of the linear regression model regarding the ratio of collateral compared to the loan size.

With respect to our first hypothesis regarding information asymmetry and collateral, we can see that the estimates of *Firm Age* have a positive effect on the presence of collateral, but the coefficient is not statistically significant (1.33). Concerning the *Audit* report (Audit), we did not find any significant effect on collateral requirements. This result could reflect that the asymmetric information is not a significant factor for SME lending in our countries.

Table 5. 1: The Determinants of Collateral

<b>Variables</b>		<b>N</b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>	<b>Std. Dev.</b>
<b>Dependent Variable</b>						
	Collateral (Yes)	114	0	1	0.86	0.35
	Collateral to Loan Ratio	101	1	6	3.39	2.04
<b>Independent Variables</b>						
	Firm age	209	1	3	2.54	0.73
	Audit (Yes)	205	0	1	0.67	0.47
	No_Bank_Relationship	189	1	3	1.42	0.52
	No_Services_Bank	185	1	4	2.28	0.93
	Years_Bank_Relationship	181	1	5	3.19	1.16
	Maturity	117	1	6	3.53	1.57
	Capital City (Yes)	209	0	1	0.34	0.48
	Concentration	209	61.25	75.34	68.33	7.06
<b>Control Variables</b>						
	Gender (Female)	209	0	1	0.39	0.49
	Education_Owner	208	1	4	3.35	0.88

	Experience_Owner	208	1	5	3.29	1.02
	Product_innovation (Yes)	209	0	1	0.63	0.48
	Process_innovation (Yes)	209	0	1	0.56	0.5
	Research_RD (Yes)	209	0	1	0.26	0.44
	Micro (Yes)	209	0	1	0.58	0.49
	Manufacturing (Yes)	209	0	1	0.23	0.42

Source: Author's estimation. Statistical significance at the 10%, 5% and 1% level indicated by \*, \*\* and \*\*\*, respectively. Standard errors are in parentheses.

Our second hypothesis is to analyse the impact of relationship lending in the presence of collateral. We have tested the effect of relationship banking on collateral with three variables: *No\_Bank\_Relationship*, *No\_Services\_bank* and *Years\_Bank\_Relationship*. First, the coefficients of *No\_Bank\_Relationship* is statistically negative, but it is not according to our expectation. We hypothesised that as the number of bank relationship increases, it would increase the information gap between the bank and the borrower due to the lack of exclusive banking relationship. However, the negative coefficient (-1.75) means that having a banking relationship with more than one lender reduces the probability of pledging collateral. With respect to the number of products and services used (*No\_Services\_Bank*) and relationship duration (*Years\_Bank\_Relationship*), we did not find any statistically significant result.

The third hypothesis of this study is to examine the impact of bank-borrower distance on collateral. The results show that borrowers based in the capital city are less likely to provide collateral security in their loan contract (coefficient, -0.58); however, our result is not statistically significant. It means that distance is not a significant factor for which SMEs are credit constraints in the Czech and Slovak Republic.

The fourth hypothesis of this thesis is to examine the impact of loan maturity (*Maturity*) on collateral. This study hypothesised that as the loan maturity of increases, it also increases the probability of pledging collateral for SME loans. We find evidence that loan maturity is positively connected with the pledge of collateral and which is significant at 1%. Hence, we accept our hypothesis that the long-term loans are more likely to be collateralized compared to the short-term loans.

Finally, we hypothesised that as the bank concentration (*Concentration*) increases it reduces the probability of pledging collateral in SME lending. However, the positive coefficient of the study indicates that banking concentration increases the probability of pledging collateral. Therefore, we can say that in a concentrated market, banks may use their market power to increase collateral requirements for small businesses.

We did not find any effect of bank borrower distance on the size of the collateral. The distance variable (*City*) is positive, but it is not statistically significant.

This study finds a statistically significant (significant at 10%) negative relationship between the size of collateral and bank market concentration. This result may highlight

that once the market gets concentrated, it reduces the size of collateral compared to the loan size. This result suggests that in a concentrated market, a borrower can borrow with a lower amount of collateral security.

### **5.1.3 Econometric Results: Financial Constraint on Innovative SMEs**

Table 5.3 presents the econometric analysis of financing to innovative SMEs. In this part of the analysis, we show whether the innovative SMEs are more likely to face credit rationing compared to than the non-innovative SMEs. In model 1 and 2 we did not find any significant effect of *Innovation and Product Innovation* and loan approval. Hence, we reject our hypothesis that firms having innovation and product innovation face more credit rationing compared to the firms that do not introduce any new products in the market. In model 3, we included the *process innovation* and the loan approval of the innovative SMEs. The negative coefficients of -0.21 are statistically significant at the 10% level, and we can infer that the process innovation could have a negative effect on SMEs that would like to obtain loans from the bank. The result reflects that banks consider the process innovation riskier and hence, they are reluctant to lend to the process innovative SMEs. In model 4, we also found a statistically negative significant result of *R&D (R&D)* and credit rationing to innovative SMEs. The result is significant at the 10% level and confirming our hypothesis that the SMEs investing in R&D activities are more likely to face credit rationing from the banks. Thus, credit rationing is hampering the innovation set-up for SMEs.

In model 5, we included all innovation variables, and the result is consistent for the product, process and R&D investment and credit rationing. We also found that firms engaged in R&D activities are highly likely to face credit rationing. Therefore, referring to the results of the study, we can say that our hypothesis (Hypothesis 6) regarding innovative SMEs and financial constraints is partially supported. On the other hand, we did not find enough statistical evidence to say that SMEs involved in the product innovation (Hypothesis 7) face more credit constraints than the process innovation. Contrary, the results suggest that the process innovation has a negative effect on the loan approval. Therefore, it means that the process innovation is considered as riskier compared to the product innovation.

Table 5. 2: Approved Loan Application (Financial Constraints: Innovative SMEs)

	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>	<b>Model 4</b>	<b>Model 5</b>
Variables	<b>Approved (1/0); logit</b>	<b>Approved (1/0); logit</b>	<b>Approved (1/0); logit</b>	<b>Approved (1/0); logit</b>	<b>Approved (1/0); logit</b>
<b>Innovativeness</b>					
Innovation (Yes)	0.05 (0.59)				
Product_innovation (Yes)		0.25 (0.56)			0.47 (0.66)
Process_innovation (Yes)			-0.21 (0.14)*		-0.40 (0.14)*
R&D (Yes)				-0.17 (0.09)*	-0.10 (0.06)*
<b>Control Variables</b>					
Age	0.49 (0.15)**	0.50 (0.13)**	0.44 (0.14)**	0.50 (0.13)**	0.42 (0.1)**
Education_Owner	0.03 (0.25)	0.02 (0.25)	0.04 (0.26)	0.04 (0.25)	0.04 (0.26)
Experience_Owner	-0.11(0.34)	-0.13 (0.34)	-0.08 (0.35)	-0.12 (0.34)	-0.10 (0.36)
Gender (Female)	-0.41 (0.46)	-0.43 (0.46)	-0.40 (0.54)	-0.42 (0.46)	-0.48 (0.47)
Audit (Yes)	0.31 (0.74)	0.32 (0.74)	0.33 (0.75)	0.36 (0.75)	0.35 (0.75)
Micro (Yes)	-0.54 (0.58)	-0.54 (0.57)	-0.52 (0.53)	-0.55 (0.58)	-0.50 (0.58)
Manufacturing (Yes)	0.16 (0.52)	0.10 (0.53)	0.24 (0.53)	0.16 (0.50)	0.17 (0.58)
Capital_city (Yes)	0.50 (0.58)	0.51 (0.57)	0.48 (0.58)	0.46 (0.59)	0.46 (0.60)
No_Bank_Relationship	-0.42 (0.1)*	-0.44 (0.14)*	-0.39 (0.13)*	-0.41 (0.13)*	-0.46 (0.13)*
No_Services_Bank	0.45 (0.30)	0.44 (0.30)	0.47 (0.31)	0.47 (0.30)	0.47 (0.31)
Years_Bank_Relationship	0.23 (0.09)*	0.24 (0.09)**	0.24 (0.08)**	0.23 (0.08)**	0.25 (0.09)**
Concentration	-0.06 (0.05)	-0.07 (0.05)	-0.06 (0.05)	-0.05 (0.05)	-0.61 (0.05)
Observations	89	89	89	89	89
Constant	1.78 (3.99)	2.05 (3.02)	1.26 (4.05)	1.23 (4.14)	1.43 (4.20)
R Squared	0.24	0.25	0.25	0.24	0.25

Source: Author's estimation. Statistical significance at the 10%, 5% and 1% level indicated by \*, \*\* and \*\*\*, respectively. Standard errors are in parentheses.

## **6. CONCLUSIONS**

### **6.1 Introduction**

The studies on entrepreneurial finance argue that SMEs are often credit rationed from commercial banks due to excessive collateral requirement and because of their innovation initiatives. In this study, we wanted to explore both of the issues in bank-based economies like the Czech and Slovak Republic. The first broader aim of the thesis was to understand the factors that affect the determinants of collateral and the second aim of the thesis was to examine whether innovative SMEs find it difficult to access bank loans compared to the non-innovative ones.

To examine the issues, we have collected data through an online survey from a sample of 218 SMEs (106 in the Czech Republic and 112 in the Slovak Republic). The response rate of the survey was about 21.4%. To achieve the goal of the study, we have developed five hypotheses to test the determinants of collateral and two hypotheses to explore credit rationing to innovative SMEs. This study used binary logistic and OLS regression models to examine descriptive statistics presented the hypotheses and overview of the data.

### **6.2 The Determinants of Collateral: Summary of the Main Findings**

The empirical analysis of the study shows that there is no effect of asymmetric information on the presence of collateral. At least both of our proxy variables (firm age and audit) related to information asymmetry doesn't show any significant relationship. Hence, we rejected our hypothesis that asymmetric information increases the probability of collateral in SME lending. The results related to relationship lending is mixed. We found that the number of banking relationship has a negative effect on collateral; however, we expected to find a positive relationship due to less exclusive banking relationship. On the other hand, we found that the years of banking relationship helps to reduce the incidence of collateral. That means that as the SMEs maintains a long-lasting banking relationship with their banks, it may enhance trust with the banks and by which the firm can obtain loans with a lower collateral. However, we did not find any effect of the number of products and services purchased from the bank and the incidence of collateral. The study finds a statistically significant positive relationship between loan maturity and collateral. Therefore, the result proposes that if a borrower would like to borrow for a longer period, he/she needs to provide collateral compared to a short-term loan. The result is according to our expectation. We expected that the long-term loans are riskier than the short-term loans, and hence, long-term loans are more likely to be secured with collateral.

### **6.3 Financial Constraints on Innovative SMEs: Summary of the Main Findings**

The second broader goal of the thesis was to investigate whether the innovative SMEs are facing more credit constraints compared to the non-innovative SMEs. The existing literature on financing to innovative SMEs argue that innovative SMEs are more likely to face credit rationing from banks because innovative SMEs are more information opaque compared to the non-innovative ones. This study did not find any significant effect of innovation and loan application being rejected. Therefore, we cannot say that innovative SMEs are facing more credit rationing than the non-innovative SMEs. Similarly, we did not find any significant relationship between product innovation and credit constraints. Thus, product innovation is not a sub-optimal decision of the SMEs for which their loan application will be rejected in the Czech and Slovak Republic. However, we found a statistically significant negative relationship between the process innovation and loan application acceptance. That suggests that the process innovation is considered as risky from the bank's perspective, and that is why the loan applications are more likely to be rejected by banks in our examined countries. Concerning R&D and credit rationing, this study finds that SMEs that are involved in R&D activities are more likely to face credit rationing more than the firms that do not invest in R&D. Hence, it could be difficult for the SMEs in our examined countries to find external finance if they would like to invest in research and development.

### **6.4 Contribution of the Study**

The aim of the study was two-fold. First, we wanted to shed light the determinants of collateral-based lending. The second goal of the thesis was to investigate whether the innovative SMEs are facing higher credit rationing compared to the non-innovative SMEs or not.

With respect to collateral-based lending, the results of the study highlight a few significant contributions towards SME financing literature and for managerial practice. As per our knowledge, this is the first study in Czech and Slovak Republic that uses primary data to provide the determinants of collateral and the factors that determines the ratio of collateral in compared to the loan size. Moreover, as per our knowledge, this is the first study that used both firm-level and bank market-level data to provide a comprehensive analysis of the determinants of collateral. Regarding the empirical results, the information problem and collateral, we did not find that asymmetric information has any significant effect on collateral, thus focusing too much on the information issue may not solve the problem of collateral in SME lending. This study further shows that the long-term loans are pledged with collateral; therefore, this result is a further confirmation of the existing studies that the long-term loans are considered as riskier than the short-term loans and therefore, banks require collateral security.

Furthermore, we show that banking concentration is not suitable for SMEs to borrow with lower collateral. Our findings suggest that bank market concentration increases the collateral requirement for SMEs; therefore, those studies suggested that concentration strengthened bank borrower relationship is not applicable in the context of the Czech and Slovak Republic. Thus, the study provides first confirmation from the Czech and Slovak Republic perspective that distance is not a factor in SMEs lending in the modern economic system.

Regarding financing to innovative SMEs, we show that innovation is not considered as riskier by banks, and therefore, we did not find any relationship with direct loan rejection in our analysis. Thus, we can conclude that innovative SMEs are not facing absolute credit rationing from banks. With the magnitude of the result, this study contributes to the existing literature that innovation is not entirely treated as risky by banks. However, the negative effect of process innovation and the credit constraint suggests that banks in the Czech and Slovak Republic consider the process innovation riskier than the product innovation. This finding is quite significant for existing academic literature. The studies show that product innovation is more credit rationed than the process innovation, but the result suggests process innovation faces higher credit rationing. According to our knowledge this the first study to provide partial credit rationing for the innovative SMEs in academic literature. Thus, our results can be important for the SMEs to understand which type of innovation is not desirable by banks to obtain loans.

## **6.5 Managerial Implications and Policy Recommendations**

The goal of the thesis was to find the determinants of collateral and examine credit rationing for the innovative SMEs in the Czech and Slovak Republic. The study finds a few interesting results which have practical implications for the managers, researchers and policymakers.

First, the managers of the SMEs should not be shy to apply for bank loans by thinking that their loan application would be rejected because of information asymmetry. Second, the findings of the study suggest that relationship banking can be beneficial for the SMEs to obtain loans with lower collateral from the bank. Therefore, the managers of the SMEs in the Czech and Slovak Republic may maintain a close banking relationship with the bank by which they can reduce the incidence of collateral. Third, the study suggested that the long-term loans are more likely to be collateralised than the short-term loans; therefore, the managers of the SMEs need to find projects where they can invest for a shorter period if they would like to obtain loans with lesser collateral. On the other hand, if they cannot find any short-term projects than the managers need to negotiate with the bank more intensively so that they can reduce probably of pledging collateral. Fourth, the study shows that bank-borrower distance is not a determining factor of collateral-based lending. Therefore, SMEs can contact via phone, emails or can apply for loans



through the online platform by which they can reduce the transportation costs as well as travelling time.

Fifth, as innovative SMEs are not facing absolute credit rationing; hence, the managers should be motivated to apply for bank loans. On the other hand, product innovation is not considered as risky from the bank's perspective, and thus the managers of the innovative SMEs should be more active to try different product innovations which can help them to increase their competitiveness in the market. However, as the study suggests, process innovation is riskier than the product innovation than the SMEs may try to improve their product portfolio than trying to improve the existing process. The results of the study could be used by policymakers to implement policies by which they can implement banking and SME lending policies in the Czech and Slovak Republic.

## **6.6 Limitations of the Study and Future Research**

Despite a few important findings in collateral-based lending and financial constraints on the innovative SMEs, this study has a few limitations. First, the data set of the study is only based on a year data, our survey was done in 2018 and hence it could be difficult to generalise the findings of the study. Second, the data set of this paper is quite limited and may not represent the total country; therefore, take a broad view the results could be an issue of the study. Third, the results of the study are based on the survey data, and the survey is just an opinion of the business owner, and that may not be the actual business condition of the country or actual financial issue of the country. Fourth, we have only considered the respondents who have obtained loans from the bank; thus, we don't know the financial conditions of the SMEs those have loans from other external lenders. Hence the results may not reflect all the SMEs in the country.

The future research may involve collecting data from a larger group of people than this study reported and compare the results whether the results are still valid or not. This study only considers SMEs, but future research may engage large firms as well and see what the difficulties are, they face and especially with regards to the size of collateral and their innovativeness. It could also be interesting to collect data from neighbouring countries, like Poland, Hungary, Austria, Germany and compare the results with the Czech and Slovak Republic by which it will be possible to comment on the level of collateral and firm innovativeness in the central and western European countries. This study only identified the most preferred collateral by banks while asking for loans; however, it may also be interesting to see what the most suitable collateral are for easy availability of finance.

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# AUHTHOR'S CURRICULUM VITAE

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## WORK EXPERIENCE

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Financial Reporting and Accounting Specialist (Novartis) – East Hanover, NJ, USA.

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## EDUCATION

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- The main objective of the thesis is to find out the financial constraints that are experienced by SMEs while they are looking for external finance in Czech Republic and Slovakia.
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- Recipient of Scholarship from Tomas Bata University in Zlin for pursuing PhD.
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Ashiqur Rahman, Ph.D.

**Financial Constraints on Small and Medium Enterprises (SMEs):  
Evidence from the Czech and Slovak Republic**

Finanční omezení pro malé a střední podniky (MSP): evidence z České a Slovenské republiky

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